

creasing backwards till near their ends, and the anterior dorsal rays are free at their ends; but as the species agrees so closely in other external characters, I feel compelled to retain it in that genus for the present at least.

In this connection, I may also mention a species found at Pensacola, which exhibits several characters in common with the species referred to, but represents a distinct genus closely related to *Chænopsetta*, *Paralichthys* and *Pseudorhombus*; the naso-dorsal side of the rhombic outline is very convex; the supra-ocular region depressed; the interorbital area formed by a narrow, scaleless ridge; the caudal peduncle short; the scales ctenoid, and the dorsal and anal fins respectively highest, and convergent far behind and at nearly the same vertical. The species has a height of little less than half the extreme length; the head almost a fourth, and the caudal almost a fifth. The first fin rays are the longest and filiform, progressively increasing, and the fin itself commences at a vertical between the orbit and pupil. The rays of the dorsal (70) converge towards the fiftieth; those of the anal (56) towards the thirtieth.

The color is reddish brown, with four ocellated spots larger than the eye; the first above the longer declining portion of the *fulciform* arch of the lateral line; the three posterior forming the angles of a triangle; the anterior two midway between the snout and caudal margin, and the posterior on the lateral line. It may be named *Ancylosetta quadrocellatus*.

On the Characters of the higher Groups of REPTILIA SQUAMATA—and especially of the DIPLOGLOSSA.

BY E. D. COPE.

Since it is only by an attentive consideration of the peculiarities of organized beings that their relationships in time present and past can be determined, the more complete that examination the more certain will our conclusions be. In the course of preparation of systematic work, the great need of well established bases is often felt, and nowhere more urgently than among the Reptiles. The following abstract, presenting some new views in this department, have been taken from my MSS., as exhibiting some of the stronger points among the multitudinous variations of the reptilian skeleton.

Prof. Johannes Müller* has given us the best characters for distinguishing the Ophidia and Lacertilia, viz.:—The former having the ali- and orbito-sphenoid regions osseous—the latter membranous; there being one suspensorium for the quadratum in the first, two in the second. It is true he says *Acontias* forms an exception, having but one suspensorium, but I have seen the second in a specimen prepared by Herr Will, of Munich, and Prof. Peters showed it to me in a Berlin specimen. *Anelytrops*, a genus nearly allied to *Typhlosaurus*, possesses both, well developed. *Aniella*, however, appears to constitute a real exception to the rule, having but one suspensorium, thus resembling the *Ophiosaurii* or *Amphisbænia*: it resembles the latter so in its elongate temporal, continuous with the parietal, the downward prolongation of the latter bone and its close union with the occipital sclerotome, as to connect them closely with the Lacertilia. The true hiatus in the series of Squamata is, in my opinion, to be found between the *Ophiosauri* and *Tortricina*. The characters of the skeleton remaining up to the present time, by which Lacertilia and Ophidia may be distinguished, are as follows:

Lacertilia.	Ophidia.
Continuity of the parietal and sphenoid walls interrupted.	Continuity of parietal and sphenoid walls complete.
Rami of the mandible united by suture.	Rami united by ligament.

From the centre of multiplicity of forms of typical Lacertilia, we can pursue

* Tiedemann and Treviranus Zeitschr. f. Physiologie, iv. p. 233.

three series—one toward the serpents by Amphisbænia, one to the partially degraded type of the Geccos, and lastly through the highest or acrodont series, to Chamaleo on the one hand and Hatteria on the other.

In the first case the prolonged development of the superior temporal is followed by a decurving of the parietal border, the closer attachment of the occipital sclerotome, and shortening of the squamosal and mastoid. Finally, the temporal, with the pieces adjoining anteriorly, begin to restrict a foramen ovale, the orbito-sphenoid is developed, and the articular and angular pieces of the mandible are represented by but one piece: the columella disappears. In the last direction, the temporal is not elongate, nor is there any tendency toward a more complete closure of the cranial cavity. The inferior or ? petrous wing of the temporal is directed inwards instead of forwards; the parietal fontanelle does not diminish, and the premaxillary bone is seen to form a regularly decreasing series. The mesosternum and columella diminish in length and disappear, and the splenial appears smaller and smaller to extinction. The subarticular strengthens the inner rather than the outer wall of the mandible, and the external direction of the coronoid is reversed. The type of Hatteria doubles the premaxillary, and exhibits the vertebræ amphicœlian.

In approaching the Geccos, the bones of the palate are seen to be thinner and more expanded, and the articular piece of the mandible is lost. In the full type the ossification is of the lightest description, and the fascial and basement membranes often present incomplete deposits of bony tissue; thus the parietal and sternal fontanelles disappear. The parietals are not, as usual, united, and there is a diminution (in Uroplates nearly obliteration), of the median or basilar segment of the occipital condyle. There is a temporal ala peculiar to this suborder.

The following is a synopsis of the prevailing characters of the suborders: *

ACRODONTA.

Shanks of teeth compressed, most always between two alveolar walls.

Coronoid bone produced posteriorly, on outside of ramus.

Articular present separate from angular. Splenial reduced, more frequently wanting.

Subarticular small on outer, much prolonged on inner face of ramus.

Groove from splenial to mental foramina not closed over Meckel's cartilage.

Premaxillary nearly always separated from vomer by maxillaries.

Pterygoids not touching body of sphenoid.

Frontal not arching over the olfactory lobes.

Parietal single, receiving the gomphosis of loosely attached occipital segment internally.

Temporal with longitudinal wing only; superior plate not produced beyond the arched body.

Orbitosphenoid wanting.

Suspensoria two, arches complete.

Rhaptoglossa and *Pachyglossa*.

NYCTISAURA.

Shanks of teeth cylindrical, attached to the inner side of an alveolar wall.

Coronoid bone produced anteriorly and posteriorly.

Articular wanting.

Subarticular largely developed exteriorly, not interiorly.

Splenial elongate; Meckel's cartilage covered between the splenial and mental foramina.

Premaxillary broad, in contact with vomer.

* Not a few of the characters here noted are pointed out in special cases in Stannius' most excellent *Zootomie der Amphibien*.

Pterygoids not touching sphenoid.

Frontal arching under olfactory lobes.

Parietal double; attachment of occipital segment very open; gomphosis internal.

Temporal with anterior vertico-oblique wing; superior plate produced beyond arched body, forming abutment for columella.

Orbitosphenoid wanting. Arches incomplete. Suspensoria two.

Vertebrae usually ampicælian.

Tongue papillose.

Nyctisaura.

PLEURODONTA.

Shanks of teeth cylindrical, attached to inner side of one alveolar wall.

Coronoid bone produced anteriorly, not posteriorly.

Articular, when present, separate from angular, (except in one tribe.)

Subarticular little developed on inner, usually much on outer face of ramus.

Groove for Meckel's cartilage nearly always more or less completely closed.

Splénial nearly always elongate.

Premaxillary in contact with vomers, (with two or three exceptions.)

Pterygoids not touching sphenoid.

Parietal single, receiving gomphosis of the usually slightly attached occipital internally.

Temporal with inferior longitudinal wing only, columella abutting on parietal or incomplete. Suspensoria nearly always two.

Orbitosphenoid wanting; vertebrae procælian.

Iguania, *Diploglossa*, *Thecaglossa*, *Leptoglossa*, *Typhlopthalmi*.

OPHIOSAURI.

Coronoid bone little developed externally, covering articular internally.

Articular united with angular.

Subarticular little visible externally; elongate internally.

Splénial small; Meckel's cartilage covered on the inner side.

Premaxillary well developed, in contact with vomer.

Pterygoids in close contact with sphenoid.

Frontal under-arching olfactory lobes.

Orbitosphenoid present.

Parietal single, with a close articulation to occipital by external gomphosis.

Temporal without wing, continuous with parietal. No columella.

Arches wanting. Suspensorium, one.

Vertebrae procælian; tongue scaly.

Amphisbænia.

The characters of the tribes and the families embraced by them are as follows:

ACRODONTA.

RHIPTOGLOSSA.

Parietal arch elevated, formed of squamosal and parietal; latter not extending to mastoid.

Vertebrae procælian.

Columella wanting.

Clavicle and mesosternum wanting. Xiphisternal without fontanelle.

No angular process of mandible. Splénial none.

Tongue papillose; terminal portion projectile on glosso-hyoideum.

Toes short, opposable in two and three.

Chamæleontidæ

PACHYGLOSSA.

Parietal arch not elevated, composed of mastoid and parietal in contact.

Columella present, (sometimes very short.)

[Oct.

Clavicle proximally simple ; mesosternum anchor-shaped. Xiphisternum with two, sometimes one fontanelle.

Mandible with angular process.

Tongue papillose, simple.

Toes not opposable, all directed forwards. Agamidæ, Hatteriidæ.

PLEURODONTA.

IGUANIA.

Temporal bone superior plate not developed beyond arched body.

Frontal not under-arching olfactory lobes.

Arches complete ; not covered by dermoössification.

Articular and angular separate. Dentary produced posteriorly, not covering coronoid. Meckel's cartilage wholly or in part covered.

Premaxillary single. Suspensoria two.

Clavicle with simple proximal ends.*

Mesosternum anchor-shaped

Tongue papillose, simple.

Anolidæ, Iguanidæ.

DIPLOGLOSSA.

Temporal bone superior plate developed beyond arched body.

Frontal not under-arching olfactory lobe.

Arches complete, temporal fossa covered by dermoössification.

Articular and angular separate.

Dentale not produced far posteriorly. Meckel's cartilage covered.

Premaxillary single. Suspensoria two.

Clavicle with simple proximal ends.

Mesosternum cruciform or rarely simple. No Xiphisternal fontanelle.

Tongue papillose, sheathed at tip. Supranasal plates numerous.

Anguidæ, Gerrhonotidæ, Helodermidæ.

THECAGLOSSA.

Temporal bone superior plate developed beyond arched body.

Frontal under-arching olfactory lobes.

Arches not complete ; fossa not covered by dermoössification.

Articular and angular separate.

Dentary short, not developed posteriorly. Meckel's cartilage exposed in its groove.

Premaxillary single. Suspensoria two.

Clavicle with simple proximal end.

Mesosternum anchor-shaped.

Tongue smooth, sheathed at base.

Varanidæ.

LEPTOGLOSSA.

Temporal bone superior plate developed beyond arched body.

Frontal with a larger or smaller ridge on each side of olfactory lobes ; no arch.

Lateral arches complete.

Articular and angular separate.

Dentary, lower posterior process often short, often long. Groove for Meckel's cartilage mostly overarched. Suspensoria two.

Premaxillary single or double, without exterior marginal foramen.

Clavicles proximally much dilated, usually perforate or enclosing a foramen.

Mesosternum cruciform ; not more than one pair of supranasal plates.

Tongue squamous or obliquely plicate.

* The transverse limb of the mesosternum, extending to the angle of the clavicle, gives an appearance in some of the Basiliscinæ of a proximal foramen.

α Premaxillary simple.	β Premaxillary double.
Teiidæ.	Scincidæ.
Lacertidæ.	Sepsidæ.
Chalcididæ.	
Ecpleopidæ.	

TYPHLOPHthalmi.

Temporal bone superior plate elongate.
 Arches incomplete or wanting.
 Articular and angular confluent. Suspensoria one or two.
 Dentary, inferior process elongate.
 Premaxillary single or double.
 Clavicles very slender, transverse rudimentary or wanting.
 Mesosternum and other sternal pieces wanting.
 Tongue squamous or papillose, simple.—*Anelytropidæ*, *Acontiidæ*,
Aniellidæ.

Of the families here proposed or adopted, the *Anolidæ* deserves first mention. Its peculiarities are—want of articular bone; absence of xiphisternal fontanelle; presence of abdominal ribs; in these points agreeing with the *Nyctisaura* or *Geconidæ*, and differing from the mass of the *Iguanidæ*. Still, among the latter *Polychrus* forms a close connection, wanting the xiphisternal fontanelle, and having the abdominal ribs.

Anguidæ.—This family I have constructed from fragments of the old *Zonuridæ* and *Scincidæ*; agreeing with Peters in referring the Old World representatives of the former to the *Lacertidæ*, and those of the New to the neighborhood of *Heloderma*. From the *Scincidæ* I have taken the New World *Diploglossinæ*, finding them possessed of the same peculiar characters which associate the *Pseudopus* with *Gerrhonotus* and *Heloderma*. The families represented by these types differ as follows. None of them have the dilated maxillary laminae of the *Scincidæ*:

A foramen (often large) from nasal meatus to palate on each side of premaxillary. Internasal plate large, transverse. Two or more pairs of supranasals.*
 Head shielded behind. Mesosternum cruciform... *Anguidæ*.

No premaxillary foramen. Two or more pairs of supranasals. Internasal plate small or wanting. Head scaled behind. Mesosternum cruciform..... *Gerrhonotidæ*.

No premaxillary foramen. Head tubercularly scaled.
 Mesosternum simple..... *Helodermidæ*.

There are four sub-groups among the genera of *Anguidæ*, viz.: *Opheosaurinæ*, with the anterior limb of the mesosternum very short or wanting; the dorsal scales in cross rows and a lateral fold; genera *Dopasia*, *Pseudopus*, *Opheosaurus* and *Opheodes*: *Opheomorinæ* without side fold, and with transverse dorsal rows, *Opheomorus*: *Anguinæ* with shortened mesosternum, quincuncial dorsal scales and no lateral fold—*Anguis*: *Diploglossinæ* without lateral fold, with elongate anterior limb of mesosternum and quincuncial dorsal scales, containing *Onida*, *Panolopus*, *Sauresia*, (= *Embryopus* Weinl.) *Diploglossus*, *Microlepis* and *Camilia*: (in *C. monotropis* Pet. I have observed an apparent exception to the rule of the retractility of the end of the tongue in this tribe.)†

Of the *Gerrhonotidæ* I know but the two genera, *Barissia* and *Gerrhonotus*. *Xenosaurus* Pet. resembles the succeeding family rather than this; I have not had the opportunity of seeing its sternum.

Among the *Leptoglossæ* with a simple premaxillary, the *Teidæ* only have

* Except *Opheomorus*.

† Vid. Proc. A. N. S. 1862, 188.

not the temporal fossæ roofed over by ossified, or much thickened dermal plates. The families may be thus compared:

α. Premaxillary single.

- Temporal fossæ not roofed; tongue squamous papillose
in oblique series, or squamous. Nostril in plate
or suture: always a xiphisternal fontanelle..... *Teiidae*.
Temporal fossæ roofed; tongue wholly or partially with
oblique plicæ projecting forwards and inwards;
nostril on intersquamal suture..... *Lacertidae*.
Temporal fossæ roofed; tongue squamous; nostril in
single plate..... *Eubleopidae*.

β. Premaxillary double.

- Temporal fossa roofed. Tongue squamous. Nostril in
a single plate; palatine maxillary laminae dilated;
rarely a xiphisternal fontanelle..... *Scincidae*.
Temporal fossa roofed; tongue squamous. Nostril in
notch of rostral; palatine maxillary laminae often
dilated..... *Sepsidae*.

I do not know the complete characters of the Chalcidæ, but they are very near the Lacertidæ. The American *Lepidophyma*, *Xantusia* and *Cricosaura* enter the Lacertidæ, as here defined, as I have failed to find characters which separate them from this Old World family. The affinity to *Zonurus*, pointed out by Duméril, is manifested in the double parietals of the first two. *Mancus* and *Gerrhosaurus* enter the same family in all points—though the tongue is partially scaly—but in *Zonurus* there are two important exceptions in which it approaches *Gerrhonotus*, viz: the tongue is papillose, and the posterior limb bounding the clavicular foramen is wanting. *Tretioscincus** enters the *Eubleopidae*, but presents the peculiarity of a simple clavicle. In a species of *Brachypus* I find the clavicle not always perforate, and in *Trachysaurus* the foramen is also wanting, although the dilatation is extensive. All these families, except the first, are known to possess serpentine types; such are among the true Scincs, *Siaphus*, *Hemiergis*, *Campsodactylus*, etc. The last is a degraded form of *Mabuia*: in the second the articular and subarticular bones appear to be united: the first is, in all respects, typical of the family in its proper characters, as illustrated by the species at hand,

S. simplex† mihi.

Pygopus and *Lialis*, with simple premaxillary, enter this tribe and are perhaps types of separate families. Whether *Aprasia* belongs in this or the next is as yet a question; it has some points of resemblance to *Aniella*.‡

* *T. bifasciatus*, *Heteropus* Dum. *T. castaneicetus* Cope.

† *S. simplex*. Nasals as high as broad, not meeting above rostral: internasal much broader than long, in contact with prefrontal. Frontonasals longest transversely, with an acute inner angle, not touching in front of frontal. Latter elongate cuneiform, three-sided in front. Supraorbitals four, posterior small; frontoparietals large, extensively in contact, occipitals large, long, nearly entirely separated by the interoccipital (which is long as the frontal) and bounded exteriorly by a long exoccipital. 5 superior labials. Transverse symphyseal and mental: 1st pair infralabials in contact, and two following pairs very elongate transversely. Twenty rows scales round the middle of the body, dorsal larger; four rows broader on nape. Three toes on anterior, none on posterior extremity. Color above steel brown, below dirty yellow: a yellowish occipitonnuchal collar.

From end of muzzle to vent 3 in. 6 l. Vent to end of tail 4 in. 6 l. *Hab.* Australia.

‡ An allied genus, which will compel the union of the *Aprasiidæ* with the *Pygopidæ*, is *Pletholax mihi*, with the subjoined characters:—Posterior extremities, no preanal pores. Two pair of supranasals, nares between the anterior and first superior labial; one transverse frontonasal. Rostral oval, prominent. All the scales imbricated, with two keels and a groove between; no larger abdominal series. *P. gracilis* is *Pygopus gracilis*, Schlegel, (*Mus. Leyden*) to whom I am indebted for the opportunity of making this description. Occipitals broad, acuminate, as long as frontal and frontonasal. Three supraorbitals, posterior largest, Temporal scales large, keeled. Gulars keeled; one very large symphyseal followed on each side by two transverse labials, and these by two longitudinal narrow labials and two large infralabials. Sixteen rows of scales. Pale brown, a paler median dorsal band, two scales wide, bordered with dark brown. From South West Australia.

The families of the last tribe differ as follows :

- a.* Two suspensoria; nostril in the rostral shield. Tongue squamous. Eye concealed by epidermis; occipital segment loosely attached. No frontal under-arch..... *Anelytropidæ*.^{*}
 Eye distinct; occipital closely articulated; two premaxillaries..... *Acontiidæ*.
β. One suspensorium; nostril in a nasolabial plate; tongue papillose. Eye distinct; occipital closely articulated; one premaxillary; an inferior frontal arch..... *Aniellidæ*.

In the first family enter *Typhlosaurus*, *Feylinia*, (much the same is *Typhloscincus*) and *Anelytrops*. In these the columella is well developed. In *Anelytrops* there is a long squamosal articulated to the side of the parietal, as in *Rhineura* and *Cephalopeltis*, the premaxillary is single, and palatine laminae of the maxillary are dilated. The splenionental groove is open. There are two slender clavicles united medially and giving insertion to the thoracic hæmapophyses. These, according to Rathke, are present, but not in contact in *Acontias*, and Peters and Stannius failed to find them in *Typhlosaurus*. The pelvis I find to be represented by an oblique bone at the extremities of two pairs of ribs on each side of the vent.

The remarkable genus *Aniella* lacks the squamosal and columella, and has a single premaxillary. The parietal is continuous with the superior plate of the temporal, and is much decurved toward the sphenoid; the frontal encloses the olfactory lobes below; these characters are the most amphibænanian in the order. There are small pre- and postfrontal bones, and a slender ligamentous postorbital arch. I have as yet found no sternal pieces, and the splenionental groove is closed, as in *Acontias*.

The Ophidian suborders may be briefly summed up as follows :

- α.* Mastoid part of cranial walls: coronoid bone present.
 I. No ectopterygoid. No prefrontal. Maxillary without alveolar ridges or malar process. Rudiments of pelvis without pubis..... *SCOLECOPHIDIA*.
 II. No ectopterygoid. Prefrontal present. Maxillary with alveolar ridge and malar process. Rudiments of pelvis with pubis..... *CATODONTA*.[†]
 III. An ectopterygoid, and prefrontal. Maxillary with alveolar ridges and teeth, horizontal, in contact with prefrontal..... *TORTRICINA*.
β. Rudimentary posterior extremities..... *Tortricidæ*.
ββ. No rudiments of extremities..... *Uropeltidæ*.
αα. Mastoid not entering cranial walls, projecting. Ectopterygoid present.
 IV. O. maxillare horizontal, produced to premaxillare, provided with solid teeth. No rudiments of pelvis. *ASINEA*.
α. Coronoid present; rudimental posterior extremities. Coronoid and articular very elongate-slender. No postorbital or supraorbitals; premaxillary teeth. *Xenopeltidæ*.
 Coronoid and articular short; post- and supraorbitals and premaxillary teeth..... *Pythonidæ*.[‡]
 Coronoid and articular short; postorbitals; no supraorbitals or premaxillary teeth..... *Boidæ*.
β. Coronoid bone wanting; no rudimental extremities.

^{*} *Typhlinidæ* Gray. The name Typhline is preoccupied.

[†] Vid. the important discovery of the pelvis by Peters, Monatsbe, Berlin Ac., 1863, 270.

[‡] *Loxocemus* enters this family rather than the next. Günther is right in assigning premaxillary teeth; posterior extremities, absent in his young specimen, are present in adults.

- b.* O. postorbitale produced over the superciliary region..... Achrochordidæ.*
bb. Postorbitale forming the hinder border of the orbit only. The families of this group have not yet been defined.
- V. O. maxillare horizontal, thickened, and not reaching premaxillare anteriorly, in contact with prefrontale, bearing a perforate and usually grooved tooth PROTEROGLYPHA.
α. Caudal hypapophyses bifid. Neural spines and pleurapophyses short.
 Postorbitals wanting; no splenio-mental groove..... Elapidæ.
 Postorbitals present..... Najidæ.
β. Caudal hypapophyses simple.
 Neural spines and pleurapophyses elongate. A post-frontal bone..... Hydrophidæ.
- VI. O. maxillare vertical, attached to prefontale by a ginglymus, and to the ectopterygoid without imbrication. Fang very seldom grooved..... SOLENOGLYPHA.
 Embracing the families Atractaspidæ, Causidæ, Viperidæ and Crotalidæ. For characters vid. Pr. A. N. Sci., 1859, 334.

On a Blind SILURID, from Pennsylvania.

BY E. D. COPE.

Animals deprived of the sense of sight are generally known inhabitants of subterranean areas of earth or water, although representing by their general structure, zoological groups most diverse. Among fish, two blind species of the Cod family are found in the caves of Cuba. The blind fish of the Mammoth Cave, with its sightless relative, the Typhlichthys, belong to a family represented by an eyed genus in the ditches of Carolina. Among the Catfish or Siluridæ there are sundry genera of a variety of form, in which the eyes are wanting or concealed by the skin. These are mostly South American or East Indian species, those of the latter country, of the Akysis type, approach nearest to our eyed Catfish of North America, according to the system of Bleeker. For a knowledge of the first genus of blind Silurid from our country, I am indebted to my friend Jacob Stauffer, Secretary of the Linnæan Society of Lancaster, an ardent explorer of the Zoology and Botany of Southern Pennsylvania, and who has furnished me with many valuable notes and specimens. This fish, of which specimens have been taken in the Conestoga creek, a tributary of the Susquehannah, is simply a blind representative of the ordinary type of Silurids, characteristic of North America, and is not to be arranged with the exotic groups. It, therefore, enters the group *Ictaluri*, of Gill, with our genera *Ameiurus*, *Hoplademus*, *Noturus* and *Ictalurus*, possessing especially the characters of the first. The genus may be called *Gronias*, and be explained by the following diagnosis:—Head broad, depressed. Supraoccipital bone posteriorly free. Branchiostegal membrane with ten rays. Anterior dorsal spine stout, posterior fin separated from caudal. Ventrals with eight rays. Eyes rudimental, covered by the corium. Natatory bladder present.

The species has the head broader posteriorly, and the anal fin shorter than in the allied species of *Ameiurus*. It may be called *G. nigrilabris*. The muzzle is flat and the jaws equal; the width across the occipital region is equal to the length from the end of the muzzle to the apex of the occipital crest; width below equal from the axilla of the pectoral to the base of the ventral fin. From end of muzzle to dorsal spine equal from latter to middle of adipose. Length of head four and one-fifth times in total length. Max-

* Vid. Pr. A. N. S., 1860, 75.